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(54) Joining coated fabric

(57) A water-resistant seam is formed when joining coated fabric (13, 14), for example to form a garment. Two edge regions (11, 12) of fabric having a thermoplastic coating, which is intended to be the outer surface of the joined fabric in use, are turned inwards and the inwardly turned edge regions are stitched to one another (at 10) to form a seam. The seam is covered by a tape (15) of thermoplastic material fused, e.g. by hot air and by pressure applied by a roller nip, to the thermoplastic coating.

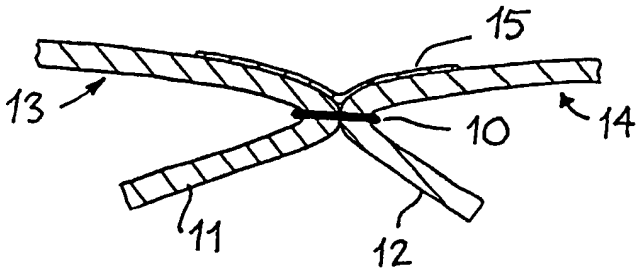

FIG.2

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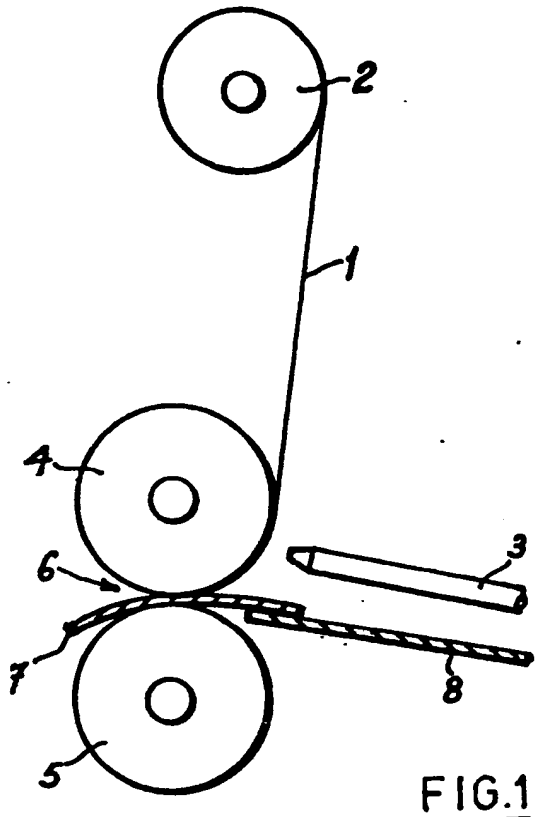

FIG.1

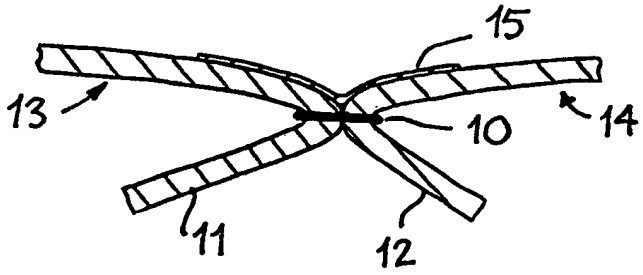

FIG.2

Joining coated fabric

This invention relates to garments and other textile articles made from coated fabrics. Fabrics having a water-resistant coating of thermoplastic material are frequently used for rainwear, anoraks and workwear and other applications requiring waterproof properties. The invention is concerned particularly with articles in which the water-resistant coating is intended to be the exterior surface of the fabric in use. One of the problems in forming such articles is concerned with the seams where two fabric edge regions (usually the edge regions of two different pieces of fabric, but sometimes two edge regions of the same piece of fabric - as in forming sleeve seams) join. The seams need to be stitched to join the fabric edge regions securely. The fabric edge regions usually must be turned inwards and stitched at the inward-facing portions to give a seam of neat appearance at the outer surface of the garment. It is difficult to make the stitched seams water-resistant.

In one known process for forming seams in such coated fabrics, the fabrics are stitched together and then welded together outside the stitching. This process can be used when the base fabric is a light-weight fabric made of thermoplastic fibres and is fusible at a relatively low temperature, for example a polyamide fabric, especially nylon-6, or a light-weight polyester fabric. It has the disadvantage however that when the garment is stretched in use in the region of the seam the weld, rather than the stitching, takes the strain first. The weld may be damaged, leading to loss of waterproof properties. Moreover, the process cannot be used successfully when the base fabric is not easily fusible, for example when it is formed at least partially of cotton, wool or acrylic fibres.

When coated fabrics are joined so that the coated surface forms the inside surface in use, the seam is made

wat rproof by adhering a tape of waterproof material to th inside (coated) surface of th fabric to cov r the seam. The tape is not visible from the outside of the garment and is generally hidden within the lining of the garment. This procedure cannot be used effectively to seal seams when the coating is at the outside of the fabric; water penetrating the stitching can soak into the base fabric which forms the inside surface of the garment.

GB-A-2132938 describes a method of joining elastomer-coated fabrics in which the pieces of fabric are overlapped without being turned inwards and are stitched to one another in this orientation, and the stitching is covered by an adhesive tape. Such a joined elastomer-coated fabric is suggested for use as a roofing or tent material; the seams would not have the neat appearance required for garments.

GB-A-979829 describes a method of joining or seaming together two pieces of proofed fabric, comprising folding over a marginal part of each of the said two pieces of fabric, stitching together the folds of said marginal parts, applying a layer of impervious material to the inner face of the article to cover the folded over marginal parts, and applying over the seam on the outer face of the article a length of an elastomeric material and vulcanising or curing such material to cause it to flow into the interstices formed at the stitched joint so as to seal the seam across which the stitches pass and to flow against the part of the inner face of said layer of impervious material exposed across the seam. Because the elastomeric material is forced through the stitched join to flow against the layer of impervious material at the inside of the fabric seam, there is a substantial thickness of vulcanised elastomeric material at the finished seam causing it to be markedly more stiff than th surrounding fabric.

A process according to th invention for forming a

water-resistant seam when joining coated fabric, in which two dg regions of fabric having a thermoplastic coating which is intended to be the outer surface of the joined fabric in use are turned inwards and the inwardly turned edge regions are stitched to one another to form a seam, is characterised in that a tape of thermoplastic material is positioned against the coated surface of the joined fabric and fused to the thermoplastic coating by the application of heat and pressure so as to cover the seam.

A garment according to the invention, formed at least in part from a fabric having a thermoplastic coating at the exterior of the garment and having a seam formed by turning two edge regions of coated fabric inwards and stitching the inwardly turned edge regions to one another, is characterised in that the said seam is covered by a tape of thermoplastic material fused to the thermoplastic coating.

The invention is particularly suitable for use in garments made from transfer-coated fabrics. In the transfer-coating process a thermoplastic resin composition is coated evenly on a release sheet, generally at a dry film thickness of 10 to 100 microns, for example 25 to 60 microns, and is air dried, preferably at elevated temperature. An adhesive is then coated over the thermoplastic layer and the adhesive-coated assembly is pressed into contact with the base fabric. The adhesive is preferably solvent-based and is dried while the release sheet is still attached to the assembled layers so that solvent from the adhesive escapes through the fabric. The thermoplastic layer is thereby securely adhered to the base fabric. The release sheet is then stripped from the assembly. Transfer coating of fabric is generally used in the industry when the coated surface is to be the outer surface of the garment.

Th th rmoplastic mat rial used for fabric coating can for example be a th rmoplastic polyurethane, which is most

pr ferr d, plasticised polyvinylchloride, a polyolefin such as polyethylene, a thermoplastic silicone resin, a thermoplastic elastomer or a thermoplastic acrylic resin. The thermoplastic polyurethane can for example be formed from a hydroxy-functional polyester, polycarbonate and/or polyether by chain extension with an aliphatic or aromatic polyisocyanate in conjunction with a low molecular weight diol or diamine. The base fabric may be a woven or warp- or weft-knitted fabric or a non-woven fabric and can be formed of any of the textile fibres and filaments known for use in such fabrics. The invention has particular advantages when the coated fabric is such that it cannot readily be welded outside the stitches, for example when the base fabric comprises cotton, wool or acrylic fibres or is a heavier weight polyester fabric.

The tape of thermoplastic material can be made of any of the thermoplastic materials listed above for use in the fabric coating. The tape preferably has a colour and gloss level such that it is not easily visible against the coated fabric when fused thereto. The thermoplastic material of the tape should be compatible with the thermoplastic coating on the fabric; the tape is preferably made of the same type of polymer as is used in the coating and most preferably of the same polymer. The tape can for example be formed from the same composition as is used to coat the fabric. Alternatively if the thermoplastic resin used in the coating is colourless and transparent the tape can comprise the same thermoplastic resin without colourants or with less colourant than the fabric coating. The colourants used can be pigments and/or dyes; pigments are preferred.

In one preferred method of forming the tape the thermoplastic material is coated evenly on a release sheet, for example rel ase-coated paper, as in the first step of preparing a transfer-coated fabric. The dry film thickness of the coating is preferably 25 to 150 microns, most

pref rably 75 to 100 microns. This is thicker than the coating on th fabric but forms a tap which is more easily handled. The thermoplastic composition applied to the release sheet is preferably solvent-based and is dried on the release sheet, for example at 50 to 150°C. A thermoplastic polyurethane, for example, can be applied from a solution in an amide solvent such as dimethyl formamide, preferably used in conjunction with a ketone such as methyl ethyl ketone and/or a hydrocarbon such as toluene or xylene. The thermoplastic material can for example be applied to the release sheet as a 20 to 40 per cent by weight solution.

The coated release sheet can be wound on a reel. It may be preferred to use a release sheet having a release coating on both surfaces. The coated release sheet can then be slit into tapes (for example, of a width in the range 10 to 50 mm), most conveniently while the release sheet is still attached to the thermoplastic material to give it stiffness. In an alternative procedure the coated release sheet can be slit into tape widths before being wound up and the release sheet-backed tapes can be reeled separately. The release sheets can be separated from the tapes before they are wound up provided that the thermoplastic material is fully dried and is sufficiently cool that it does not stick to itself. If the coated release sheet is rolled in sheet form and then slit into tapes in a subsequent operation the tapes can generally be wound satisfactorily without the release sheet backing. The tapes can alternatively be wound still attached to the release sheet, particularly if there are provisions for removing the release sheet from the tape at a work station where the tape is to be applied.

The tape can be applied to the garment using machinery known for applying tapes having heat-activated adhesives. In a preferred machine h at is applied to the tape and the garment is passed through a nip with the heated surface of

the tape contacting the coated fabric surface. Heat, for example in the form of hot air, is applied to the tape just before it passes through the nip. The heat applied is sufficient to soften the surface of the thermoplastic tape. One example of such a hot-air-jet taping machine is sold under the trademark "Ardmel Mk. 2". Radio-frequency welding and ultrasonic welding are two alternative techniques of applying the tape to the garment.

The process of the invention can be used to form a water-resistant seal for a stitched fabric seam which is inconspicuous or barely visible when seen on a garment being worn. The thermoplastic tape fuses to the plastic coating of the fabric to form a continuous layer of water-resistant material at the outer surface of the garment; water generally does not reach the stitches of the seam so there is no danger of water being spread by the base fabric. There is substantially no tendency for the joined coated fabric to pucker at the seam in use, which can be a problem with seams which are covered by fabric tapes.

The invention will now be described by way of example with reference to the accompanying drawing, in which:

Figure 1 is a diagrammatic cross-section of an apparatus for applying a tape to the seam of a garment in a process according to the invention, and

Figure 2 is an enlarged cross-section of one form of garment seam according to the invention.

The apparatus shown in Figure 1 comprises a tape 1 of thermoplastic material stored on a reel 2, a nozzle 3 for supplying hot air and rollers 4, 5 forming a nip at 6. Tape 1 is drawn from reel 2 onto roller 4 so that it is supported on the surface of the roller 4 before it enters the nip 6. Hot air is blown at the tape 1 while it is supported by roller 4 so as to soften the surface of tape

1. A garment 7 is passed along a guid 8 with its outer coated surfac facing th tape 1 so that a seam formed by a line of stitching linking two edge regions of garment fabric together contacts the tape 1 at the nip 6 where pressure is applied to the garment and the heated tape 1 so as to fuse the tape over the line of stitching and cause it to become bonded to the coating of the fabric making up the garment at either side of the seam.

The invention is further illustrated by the following Example, in which ratios and percentages are by weight.

Example

A polyurethane formed by the reaction of hexanediol polycarbonate (1000 g, 0.5 mole), butane-1,4-diol polyadipate (1125 g, 0.5 mole), butane-1,4-diol (270 g, 3.0 moles) and 4,4'-diphenylmethane diisocyanate (1000 g, 4.0 moles) was dissolved at 30 per cent in a 3:1:1 mixture of dimethyl formamide:methyl ethyl ketone:toluene. This composition was coloured with a blue pigment and coated on a heavy cotton fabric at a thickness of 45 microns by transfer coating.

The pigmented coating composition described above was coated on a release sheet and dried at 100°C to a thickness of 75 microns. The coated release sheet was wound on a reel. When it was completely cool, the sheet was slit into tapes each some 20 mm wide. Each tape was separated from its release sheet and wound on a reel.

The coated fabric was used to make a work jacket with the coating at the outside of the jacket. The seams of the jacket were formed by turning two edge regions of the coated fabric inwards and stitching the inwardly turned edg regions together. The thermoplastic tape was appli d to each seam of the jacket, using the apparatus shown in the drawing, to form a water-resistant jack t. The temp-

erature of the hot air applied to the tape was about 275°C.

Figure 2 shows one of the seams formed by a line of stitching 10 linking edge regions 11 and 12 of fabric pieces 13 and 14, respectively. The tape is shown at 15.

The seams were found to be rain resistant in use of the garment and the coated seams were not puckered by virtue of the use of the separately applied tapes. The tapes were barely visible when viewed from the outside of the jacket.

CLAIMS

1. A garment formed at least in part from a fabric having a thermoplastic coating at the exterior of the garment and having a seam formed by turning two edge regions of coated fabric inwards and stitching the inwardly turned edge regions to one another, characterised in that the said seam is covered by a tape of thermoplastic material fused to the thermoplastic coating.

2. A garment according to claim 1 characterised in that the tape has a colour and gloss level such that it is not easily visible against the coated fabric when fused thereto.

3. A garment according to claim 1 or claim 2 characterised in that the tape and the fabric coating are based on the same thermoplastic polymer.

4. A garment according to claim 3 characterised in that the tape is formed from the same composition as is used to coat the fabric.

5. A garment according to any preceding claim characterised in that the fabric coating is based on a colourless and transparent thermoplastic polymer.

6. A garment according to any preceding claim characterised in that the tape contains no colourant or less colourant than the fabric coating.

7. A garment according to any preceding claim characterised in that the tape is formed of a thermoplastic polyurethane.

8. A garment according to any prec ding claim characterised in that the base fabric compris s cotton, wool, or

acrylic fibres.

9. A garment according to any preceding claim characterised in that the thickness of the tape of thermoplastic material is 25 to 150 microns.

10. A garment according to claim 9 characterised in that the thickness of the tape is 75 to 100 microns.

11. A garment according to any preceding claim characterised in that the width of the tape lies in the range 10 to 50 mm.

12. A process for forming a water-resistant seam when joining coated fabric, in which two edge regions of fabric having a thermoplastic coating which is intended to be the outer surface of the joined fabric in use are turned inwards and the inwardly turned edge regions are stitched to one another to form a seam, characterised in that a tape of thermoplastic material is positioned against the coated surface of the joined fabric and fused to the thermoplastic coating by the application of heat and pressure so as to cover the seam.

13. A process according to claim 12 characterised in that the tape is formed by coating the thermoplastic material onto a release sheet, dividing the coated sheet into release sheet-backed tapes and separating the thermoplastic tapes so formed from the release sheets.

14. A process according to claim 12 or claim 13 characterised in that heat is applied to a surface of the tape and the tape and stitched coated fabric are passed through a nip with the heated surface of the tape contacting the coated fabric surface.

15. A process according to claim 14 characterised in that heat is applied to the tape in the form of hot air.

16. A process for forming a water-resistant seam substantially as described her in with reference to the accompanying drawing.

17. A process for forming a water-resistant seam substantially as described in the foregoing Example.

18. A garment made by the process claimed in any one of claims 12 to 17.

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